This document and process conversion measures necessary to comply with this revision shall be completed by 1 January 1997

INCH-POUND

MIL-PRF-38534C
Amendment 1
12 September 1996

PERFORMANCE SPECIFICATION

**HYBRID MICROCIRCUITS,
GENERAL SPECIFICATION FOR**

This amendment forms a part of MIL-PRF-38534, dated 23 August 1995, and is approved for use by all Departments and Agencies of the Department of Defense.

PAGE 1

1.2, second paragraph, line 1: Delete "management program" and substitute "management programs".

PAGE 2

1.3: Delete and substitute:

"1.3 Classification. Five quality levels are provided for in this specification. Four of these classes, in highest to lowest quality level order, are K, H, G, and D, as defined below. The fifth class is class E, the quality level associated with a class E device is defined by the acquisition document.

1.3.2: Delete and substitute:

"1.3.2 Class H. Class H is the standard military quality level.

Add as new paragraphs:

"1.3.3 Class G. Class G is a lowered version of the standard military quality level (H) with QML listing per 4.5.2.2, a lowered temperature range (-40°C to +85°C), a guaranteed capability to meet the Class H Conformance Inspection and Periodic Inspection testing, a vendor specified incoming test flow, and a vendor specified in-process inspection flow.

1.3.4 Class E. Class E designates devices which are based upon one of the other classes (K, H, or G) with exceptions taken to the requirements of that class. These exceptions are specified in the device acquisition document, therefore the device acquisition document should be carefully reviewed to insure that the exceptions taken will not adversely affect the performance of the system.

1.3.5 Class D. Class D is the lowest quality level available to this specification. This is a reduced temperature range (0°C to +70°C) part with a vendor specified test flow available from a QML listed manufacturer."

PAGE 3

3.1: Delete and substitute:

"3.1 Performance Requirements for Class K Devices. Class K devices shall be capable of meeting the class K tests and inspections of Appendices C and E (see Table XV). This shall include the incoming inspection flow, the in-process inspection flow, the screening flow, and the Conformance Inspection and Periodic Inspection flow. These devices shall be specified over the temperature range of -55°C to +125°C or as specified in the device acquisition document. Manufacturers of these devices shall be fully certified and qualified in accordance with this specification. Verification of these Performance Requirements shall be performed as described in paragraph 4."

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Defense Supply Center Columbus (DSCC-VAT), PO Box 3990, Columbus, OH 43216-5000, by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document, or by letter

AMSC N/A FSC 5962

3.2: Delete and substitute:

"3.2 Performance Requirements for Class H Devices. Class H devices shall be capable of meeting the class H tests and inspections of Appendices C and E (see Table XV). This shall include the incoming inspection flow, the in-process inspection flow, the screening flow, and the Conformance Inspection and Periodic Inspection flow. These devices shall be specified over the temperature range of -55°C to +125°C or as specified in the device acquisition document. Manufacturers of these devices shall be fully certified and qualified in accordance with this specification. Verification of these Performance Requirements shall be performed as described in paragraph 4."

Add as new paragraphs:

"3.2.1 Performance requirements for class G devices. Class G devices shall be capable of meeting the class H tests and inspections of Appendices C and E, except incoming inspection (see Table XV). This shall include the screening flow and the Conformance Inspection and Periodic Inspection flow. Compliance with the Conformance Inspection and Periodic Inspection flow must be guaranteed by the manufacturer. Actual completion of Conformance Inspection and Periodic Inspection tests and inspections are optional and at the manufacturer's discretion. DSCC approval or notification is not required to eliminate Conformance Inspection and Periodic Inspection tests and inspections for this class of device, however it is the manufacturer's responsibility to insure that their devices are capable of passing these tests and inspections. These devices shall be specified over the temperature range of -40°C to +85°C or a wider range. Manufacturers of these devices shall be fully certified and QML listed in accordance with this specification. Verification of these Performance Requirements shall be performed as described in paragraph 4.

3.2.2 Performance requirements for class E devices. Class E devices are devices which meet all of the requirements of one of the other classes (K, H, or G) with some exceptions taken. The SCOPE paragraph of the device acquisition document shall clearly state which class the device is based upon (K, H, or G) and what exceptions are being taken. The users of these devices should carefully examine the device acquisition document to verify that the exceptions being taken will not adversely affect the system performance. Verification of the performance requirements shall be performed as described in paragraph 4.

3.2.3 Performance requirements for class D devices. Class D devices are built and tested in accordance with the manufacturer's specified production and testing flow (see Table XV). These devices shall be capable of meeting the specified electrical tests. However, these devices are not required to meet any of the tests and inspections of this specification. These devices shall be specified over the temperature range of 0°C to +70°C or a wider range. Manufacturers of these devices shall be fully certified and QML listed in accordance with this specification. Verification of these Performance Requirements shall be performed as described in paragraph 4.

3.2.4 Performance Requirements for RHA devices. Currently, standard RHA devices are not available in compliance with this specification. When realistic and technically correct criteria is available, this criteria will be added to or referenced in this specification."

Add as new table:

"TABLE XV. Performance Requirements Summary.

Test Flow or Requirement 1/	Class				
	D	E 2/	G 2/	H 2/	K 2/
Certification	Required	Required	Required	Required (Class H)	Required (Class K)
QML Listing	Required per 4.5.2.2	Required per the applicable device class and the acquisition document	Required per 4.5.2.2	Required per 4.5.2.1 and App. D	Required per 4.5.2.1 and App D
Incoming Inspection (App. C)	Manufacturer Specified 3/		Manufacturer Specified 3/	Applicable (Class H) 1/	Applicable (Class K) 1/
In-Process Inspections(App. C)	Manufacturer Specified 3/		Applicable (Class H) 1/	Applicable 1/	Applicable 1/
Screening (App. C)	Manufacturer Specified 3/		Applicable (Class H) 1/	Applicable (Class H) 1/	Applicable (Class K) 1/
Conformance Inspection and Periodic Inspection (App. C)	Manufacturer Specified 3/		Guaranteed (Class H) 4/	Applicable (Class H) 1/	Applicable (Class K) 1/
Temperature Range 5/	0°C to +70°C		-40°C to +85°C	-55°C to +125°C	-55°C to +125°C

1/ For test flow implementation and available flexibility see 3.3.1.
2/ Design and construction and rework criteria is as specified in appendix E and shall be utilized per 3.3.1.
3/ Manufacturer Specified means that the manufacturer does not have to take the generic criteria of this specification into consideration during the establishment of its manufacturing and test flows. The manufacturer's flow may or may not meet the same requirements as the flow of this specification. Furthermore, the manufacturer may specify that they do not perform the particular test or inspection flow.
4/ Guaranteed (Class H) means that the manufacturer is assuring that their devices will meet the Conformance Inspection and Periodic Inspection test flow contained in Tables IXa, IXb, IXc, and IXd, but may or may not actually perform the tests and inspections specified. Elimination of these tests and inspections does not necessitate DSCC approval or notification.
5/ Wider temperature ranges are also acceptable for classes D and G. Class H and K shall be -55°C to +125°C unless otherwise specified in the acquisition document."

3.3.1: Delete and substitute:

"3.3.1 Implementation of this specification. All devices offered and shipped in compliance with this specification shall meet the performance requirements specified for the applicable device class. The manufacturer shall verify that their devices meet the performance requirements of the applicable device class. The manufacturer is responsible for developing a verification program which will meet this requirement. The appendices of this specification give standard methods for verifying that the devices meet the performance requirements (except for class D). The manufacturer may address the requirements of this specification as written, adapt them to their products, or develop a new methodology. Prior to the manufacturer being certified the actual verification program to be used shall be reviewed and approved by DSCC. Any deletions or changes to the test flow shall also be reviewed and approved by DSCC or the manufacturer's DSCC approved TRB (see appendix B) prior to implementation. In this manner a manufacturer may use an alternative method to the method specified in this specification to evaluate their parts if the alternate method verifies the same performance requirement. Furthermore, the manufacturer may eliminate a test or inspection (or decrease the occurrence or sample size of the test or inspection) if it is shown that the test or inspection is not necessary or can be performed less frequently. It is the manufacturer's responsibility to show how their verification program (and any changes to it) meets the requirements of this specification. See Table XVI for clarification"

Add as new table:

"TABLE XVI. Implementation Summary.

Option	Definition	Typical Examples	Implementation Procedures
Meet requirement as written	The manufacturer performs the test or requirement as specified	Self explanatory	The manufacturer implements the test or requirement into internal documentation, verified during certification
Alternate method to the requirement	The manufacturer assures that the intent of the requirement is met, but does not perform the test/requirement exactly as written	- Replacement of a test with SPC or alternate method - Historical data analysis shows that the requirement is met - Design verification/validation shows that the process is capable of meeting the requirement - Requirement does not address new materials, technologies, designs	For TRB companies, alternate method and appropriate justification are approved by the manufacturer's TRB.
			For traditional companies, Manufacturer proposes the alternate method and justification to the Qualifying Activity for approval.
Elimination of the requirement	The manufacturer proves that the test or requirement is either:		
	Non-value added	- Test does not stress the process adequately (i.e., resistance to solvents for laser marking) - Historical data analysis shows that the test does not induce failures	Elimination is achieved in the same manner as alternate methods described above
	The product will not comply with the test or requirement due to technology limitations	- configuration of the product (i.e., size, mass, package, etc.) is incompatible with the test method	The exception shall be documented in the applicable acquisition document. Product is classified as class E
	Application has no need of the requirement	The device will not experience the particular stress in the application	Same as above

"

PAGE 6

3.3.5.8.3, Fourth sentence delete and substitute: "The "QML" or "CH" certification mark or the abbreviation "Q" or "C" shall not be used for any device acquired under contracts or orders which permit or require any changes to this specification except as allowed in 3.3.1."

3.4.1, line 1: Delete "suppliers, including".

4.1: Delete and substitute:

"4.1 General verification. All items shall meet all requirements of section 3. The manufacturer is responsible for verifying that product delivered to this specification meets the performance requirements as stated in 3. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of insuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling inspection, as part of manufacturing operations, is an acceptable practice to ascertain conformance to requirements, however, this does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to accept defective material."

4.3: Delete and substitute:

"4.3 Baseline process flows. Manufacturers of compliant class E, H, and K devices to this specification shall implement a baseline process flow detailing the processes, tests, inspections/monitors, material entry points, and the order in which operations are performed. Appendices C and E provide generic verifications, design, and construction criteria for use in developing these flows. The criteria and verifications identified in appendices C and E may be modified as specified in paragraph 3.3.1. The baseline flow will be verified by the Qualifying Activity, see paragraph 4.5."

Add as a new paragraph:

"4.3.1 Baseline process flows for Class D. The baseline process flow used to QML list a Class D manufacturer may be one or more of its product manufacturing flows (e.g., travelers) that are representative of the manufacturer's process and materials."

4.5, line 3: Delete "6.3.26" and substitute "6.3.38".

4.5.1: Delete and substitute:

"4.5.1 Verification audit. During the audit, the qualifying activity shall verify the adequacy of the manufacturer's quality management program to achieve at least the same level of quality as could be achieved by complying with Appendix A or B as applicable. The qualifying activity shall also verify the adequacy of the manufacturer's baselined process flow, assessing those flows' capability to produce product that can meet the generic performance verifications defined in Appendices C and D as applicable. Qualifying activity approval of the manufacturer's quality management system and baseline process flow results in QML certification, and is a mandatory precondition to QML listing. The interval between on-site reaudits shall normally be two years. However, the Qualifying Activity will adjust this interval based on the manufacturer's TRB reports or retention reports (as applicable), customer feedback, self-audit, and other indications of the manufacturer's maintenance of the QML system."

Add as new paragraphs:

4.5.1.1 Third sentence delete "baselined substrate fabrication" and substitute "substrate fabrication". Last sentence delete "during and exit critique" and substitute "during the exit critique".

Add as new paragraphs:

"4.5.1.3 Classes E, G, H, and K process flow audits. The qualifying activity shall also verify the adequacy of the manufacturer's baselined process flow, assessing those flows' capability to produce product that can meet the generic performance verifications and criteria as defined in Appendices C and E as applicable.

4.5.1.4 Class D process flow audit. The qualifying activity shall verify that the manufacturer plans the manufacturing of products, and ensures that process control is practiced in accordance with the manufacturer's defined quality management program. The manufacturer's processes and materials will also be compared to the manufacturer's selected baseline process flow (see 4.3.1) for verification."

4.5.2 Delete and substitute:

"4.5.2 Technology capability verification (qualification). In order to receive a QML listing, manufacturers shall demonstrate the capability of their processes and materials to produce products that meet the appropriate performance requirements. Manufacturers of emerging technologies or advanced technologies shall also perform technology characterization as part of their technology capability verification. As an aid to the manufacturer, Appendix D provides characterization guidance for specific technologies."

Add as new paragraphs:

"4.5.2.1 Class H and K QML listing. The manufacturer shall demonstrate the capability of products built using their baseline process flow to meet the specified performance requirements with an established reliability safety margin. An established reliability safety margin is shown by testing performed to more stringent stress levels than those specified for screening and Conformance Inspection and Periodic Inspection testing. The safety margin is specified in Appendix D as a qualification test flow. This demonstration shall be performed using data, either historical data or data specifically generated by testing performed to meet the qualification test flow of Appendix D. In order to qualify advanced or emerging technologies the manufacturer may need to modify the qualification test flow of Appendix D, the remainder of Appendix D may be used as guidance for this purpose.

4.5.2.2 Class G and D QML listing. The manufacturer shall demonstrate the ability of their baseline to produce devices which will meet the performance requirements of the respective class. This demonstration shall consist of data, either historical or specifically generated to demonstrate this capability. This data shall be presented to the qualifying activity. It is the manufacturer's responsibility to provide enough information to demonstrate that their devices are capable of meeting the performance requirements."

PAGE 8

5.: Delete and substitute:

"5. PACKAGING. Packaging shall prevent mechanical damage of the devices during shipping and handling and shall not be detrimental to the device."

6.2b, line 1: Delete "DODISS" and substitute "Department of Defense Index of Specifications and Standards".

6.3: Delete and substitute:

"6.3 Terms, definitions, methods, and symbols. For the purposes of this specification, the terms, definitions, methods, and symbols of MIL-STD-883, MIL-STD-750, MIL-HDBK-1331, and those contained herein apply and may be used in applicable device acquisition specification wherever they are pertinent. The preparing activity shall interpret these definitions for use wherever pertinent. To further describe a particular type of device, additional modifiers may be prefixed to the type name."

PAGE 10

6.3.17: Delete and substitute:

"6.3.17 Flip chip bonding: Direct attachment of a bare die face down with the surface of the die being placed in direct contact with the substrate."

6.3.28: Delete this paragraph.

PAGE 11

6.3.29: Delete this paragraph.

6.3.30: Delete this paragraph.

6.3.31: Delete this paragraph.

6.3.32: Delete this paragraph.

PAGE 11, continued

6.3.41: Delete and substitute:

"6.3.41 Tape automated bonding (TAB). The attachment of a bare die to a very fine pitch lead frame."

PAGE 12, continued

6.3.44: Add as a new paragraph:

"6.3.44 Package type. Packages which have the same case outline, configuration, materials (including bonding wire and die attach), piece parts (excluding preforms which differ only in size) and assembly processes."

PAGE 14

A.3.1.4.1: Add as a new paragraph:

"A.3.1.4.1 Process control. The manufacturer should define all processes and methods used to assure the capability and consistency of the processes. As a minimum all critical process parameters should be defined. The manufacturer should define process monitors as appropriate."

PAGE 16

A.3.2.1, line 2: Delete "MIL-H-38534" and substitute "MIL-PRF-38534".

PAGE 25

B.3.2.6, last line: Delete "and procuring activity." and substitute "and procuring activity when specified by contract."

PAGE 28

C.3.1 Add "Alternate methods are allowed per 3.3.1." to the end of this paragraph.

PAGE 30

C.3.3.7: Delete this paragraph.

C.3.3.7.1: Delete this paragraph.

C.3.3.7.2: Delete this paragraph.

PAGE 31

TABLE II: Delete subgroup 7.

PAGE 34

C.3.6: line 5 and 6: Delete "C.3.4, and C.3.5 ICD's may be assembled into devices and acceptance" and substitute "ICD's may be assembled into devices and screened per table VIII through final electrical. Acceptance ".

PAGE 44

C.5.12: Renumber as C.5.13.

Add as new paragraphs:

"C.5.12 Radiography for class K devices.

C.5.12.1 Solder sealed devices. Solder sealed devices will be tested 100 percent in accordance with MIL-STD-883, method 2012.

C.5.12.2 Non-solder sealed devices. Non-solder sealed devices will be tested 100 percent in accordance with MIL-STD-883, method 2012, unless otherwise specified.

NOTE: Radiography should only be deleted if the manufacturer and customer determine it to be unapplicable or of limited value for a given design or technology."

PAGE 45

TABLE VIII, last two rows: Delete and substitute as follows:

"

Radiographic	2012		100 percent	N/A	C.5.12
External Visual	2009		100 percent	100 percent	C.5.13

"

PAGE 50

C.6.3.3.3: Delete and substitute:

"C.6.3.3.3 Element shear for option 1 PI product qualification. The element (die/chip) shear test will be performed to a quantity (accept number) 22(0) of the elements in the devices or all elements in the two sample devices, whichever is less. The shear sample will be uniformly divided among all element types (or all elements, if less) in the device and will be performed in a minimum of two devices. The sample will include typical resistor, capacitor, integrated circuit, and discrete semiconductor elements. Alternative element shear may be conducted in accordance with D.6.7.4.11.1."

PAGE 52

C.6.4.2.4: Delete and substitute:

"C.6.4.2.4 Die shear strength. The element (die/chip) shear test will be performed to a quantity (accept number) of 22(0) of the elements in the devices or all elements in the two sample devices, whichever is less. The shear sample will be uniformly divided among all element types (or all elements, if less) in the device and will be performed in a minimum of two devices. The sample will include typical resistor, capacitor, integrated circuit, and discrete semiconductor elements. Alternative element shear may be conducted in accordance with D.6.7.4.11.1."

C.6.4.4: Delete and substitute:

"C.6.4.4 Group D inspection. Group D inspection will be performed on the first inspection lot submitted and at intervals not exceeding 26 weeks for additional inspection lots (except as modified in paragraphs C.6.4.4.4 and C.6.4.4.5). Group D inspection will be performed in accordance with table IXd and C.6.4.4.1 through C.6.4.4.5."

Add as new paragraphs:

"C.6.4.4.4 Subgroups 2 and 3. Verify complete package (may verify case and cover separately) for compliance with subgroups 2 and 3. Corrosion in the internal cavity area is not cause for rejection. This test is performed one time for class H and at 26 week intervals for class K unless a change in material or plating is made.

C.6.4.4.5 Subgroup 4. For metal cases with leads separated by an insulator, measure insulation resistance between the metal body of the case and the leads that are isolated from the case. This test does not apply to non-metallic cases. This test will be performed once for class H unless a change in insulator material is made, and on every Group D lot for Class K."

TABLE IXc: Delete and substitute:

TABLE IXc. Group C testing.

Subgroup	Class		Test	MIL-STD-883 conditions			Quantity (accept number)	Reference paragraph
	K	H		Method	PI	QML		
1	X	X	External visual	2009			5(0)	
	X	X	PIND	2020	N/A	A or B, 1/ 5 passes		D.6.7.4.1
	X		Temperature cycling	1010	C, 20 cycles	C, 100 cycles		D.6.7.4.2
		X X	Temperature cycling or Thermal shock	1010 or 1011	C, minimum or A, minimum	C, 100 cycles N/A		D.6.7.4.2 D.6.7.4.2
	X X	X X	Mechanical shock and/or Constant acceleration	2002 and/or 2001	B, Y1 direction or A, Y1 direction	B, Y1 direction and B, Y1 direction		D.6.7.4.3 D.6.7.4.4
	X	X	Seal (fine and gross)	1014				
	X	X	PIND	2020	N/A	A or B, 1 pass		D.6.7.4.1
	X	X	Visual examination	1010				D.6.7.4.5
	X	X	End-point electrical	2/				D.6.7.4.6
2	X	X	Steady-state life test	1005	1000 hours at +125°C or equivalent in accordance with 1005	1000 hours at +125°C or equivalent in accordance with 1005	22(0) or 5 (0) 3/	D.6.7.4.7
	X	X	End-point electrical	2/				D.6.7.4.6
3	X	X	Internal water vapor content	1018 at +100°C			3(0) OR 5(1) 4/	D.6.7.4.8
4	X	X	Internal visual and mechanical	2014	Option 1 only		2(0) 4/	D.6.7.4.9
	X	X	Wirebond strength	2011	Option 1 only			D.6.7.4.10 C.6.3.3.2
	X	X	Element Shear	2019 or 2027	Option 1 only			D.6.7.4.11 C.6.3.3.3

"

PAGE 55

D.1.1: Delete "level" from the third sentence and substitute "evaluation". Delete "MCM" from the fourth sentence.

PAGE 54

Table IXd: Delete and substitute:

"TABLE IXd. Group D package related tests.

Subgroup	Test	MIL-STD-883		Quantity (Accept Number)	Reference Paragraph
		Method	Condition		
1	Thermal Shock	1011	C	5(0)	
	Stabilization Bake	1008	+150C, 1 hour	5(0)	
	Lead Integrity	2004 2008	B2 (Lead fatigue) D (leadless chip carrier) (pin grid array leads and rigid leads)	1(0)	C.6.4.4.3
	Seal a. Fine b. Gross	1014	 A or B C or D	5(0)	
2	Moisture Resistance	1004		5(0)	C.6.4.4.4
3	Salt Atmosphere	1009	A	5(0)	C.6.4.4.4
4	Metal Package Isolation	1003	600V dc 100 nA maximum	3(0)	C.6.4.4.5

"

PAGE 59

TABLE X: Group Number 3 and 4: Delete and substitute:

"

3	Package integrity and contamination	Internal water vapor PIND Internal visual	Method 1018 Method 2020, cond A or B Method 2010/2017/2032
4	Post burn-in lead finish	Solderability	Method 2003 ~~or 2022~~

"

PAGE 63

D.6.5: Delete this paragraph.

PAGE 66

Add as new paragraph

"D.6.7.4.11.1 Alternative to element shear testing. The manufacturer may utilize MIL-STD-883, method 2027 to test the strength of organic and solder/alloy attachments on selected elements, except that the accept/reject criteria shall be based on an acceleration on the element of 50,000 g's in the Y1 direction (i.e., the minimum acceptable pull strength shall be 50,000 times the weight of the element).

NOTE: This alternative test is only appropriate for elements whose element thickness or mass is small in proportion to the area of attach (e.g., 10 mil thick GaAs die). The acceptance level is more severe than die shear testing for many element types. In cases where the element is relatively massive compared to the attachment area (e.g., tantalum capacitors) this method will give a false indication of die attach strength, pass or fail."

PAGE 74

E.5.1.x: Delete "MIL-STD-480" and substitute "MIL-STD-973".

CONCLUDING MATERIAL

Custodians:
Army - ER
Navy - EC
Air Force - 17
NASA - NA

Preparing activity:
DLA - ES

Review activities:
Army - AR, MI
Navy - MC
Air Force - 19, 85, 99
DLA - ES

Civil agency coordinating activities:
DOT - FAA (RD-650)

(Project 5962-1654)